United States Patent [19]

Lindström

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[54] **DEVICE FOR MANUFACTURING CONICAL POLES**

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.**[5] **B21D 5/08**; B21D 5/12

[52] **U.S. Cl.** **72/181**; 72/52

[58] **Field of Search** 72/51, 52, 177, 178, 72/179, 181; 228/17, 17.5

[56] **References Cited**

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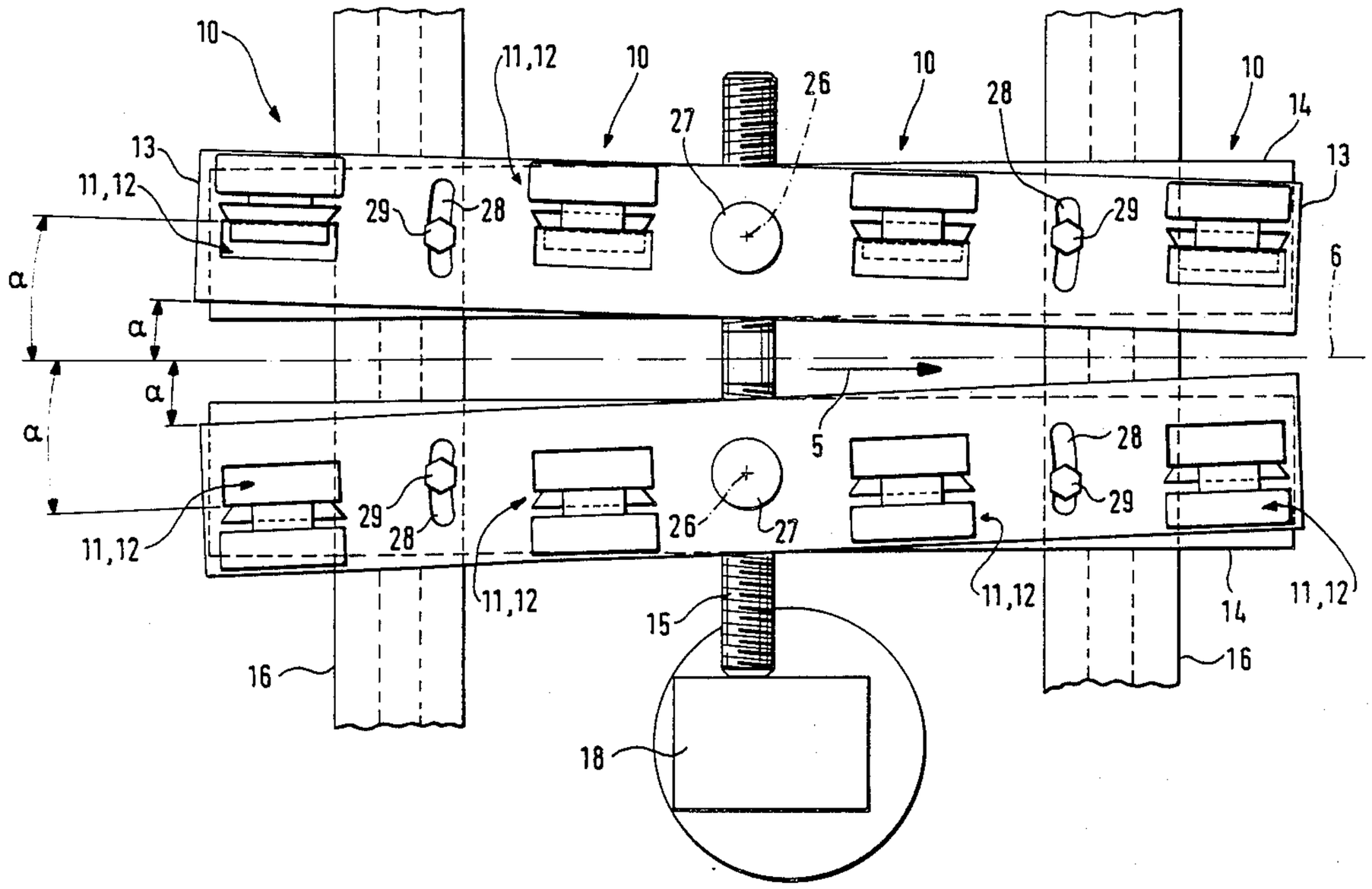
Primary Examiner—E. Michael Combs
Attorney, Agent, or Firm—Bacon & Thomas

[57] **ABSTRACT**

The present invention relates to a device for manufacturing conical poles or conical pole members by roll forming sheet metal wherein said device (**1**) includes a conveyor path (**5**) along which sheet metal is transported, and a plurality of groups (**10**) of forming rolls (**11, 12**) positioned in succession along the conveyor path (**5**). In order to facilitate the roll forming and eliminate the risk of bending the sheet metal during the roll forming, the forming rolls (**11, 12**) in at least one of the groups (**10**) thereof are mounted on frame members (**13**) which are pivotable about vertical axes (**26**) such that the forming rolls (**11, 12**) can be set to run at angles (α or β) relative to the center line (**6**) of the conveyor path (**5**) necessary to achieve a desired conical form of the finished pole or pole member or portions thereof.

3 Claims, 8 Drawing Sheets



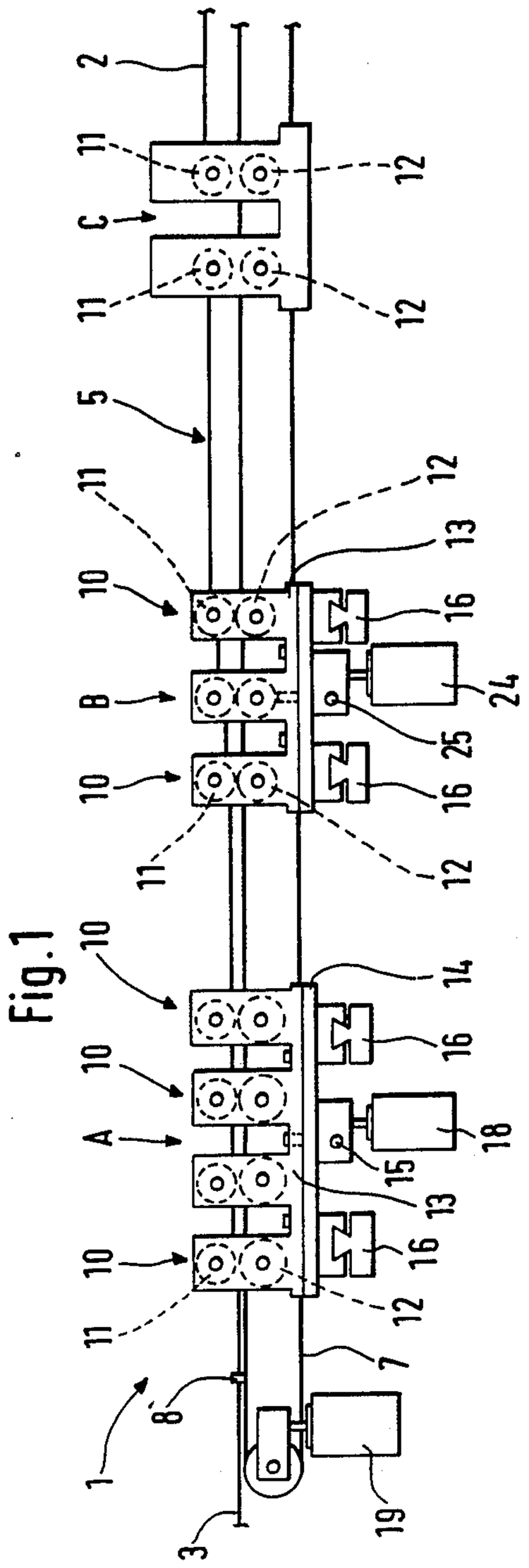


Fig. 1

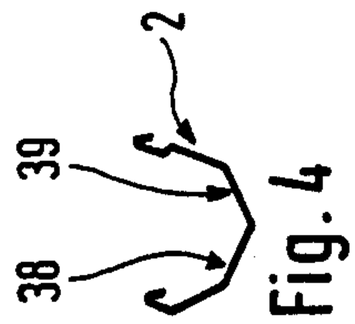


Fig. 4

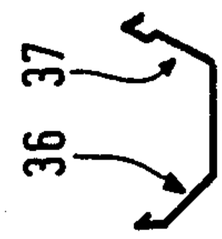


Fig. 3

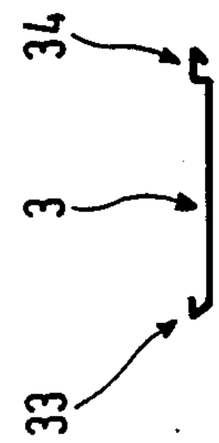


Fig. 2

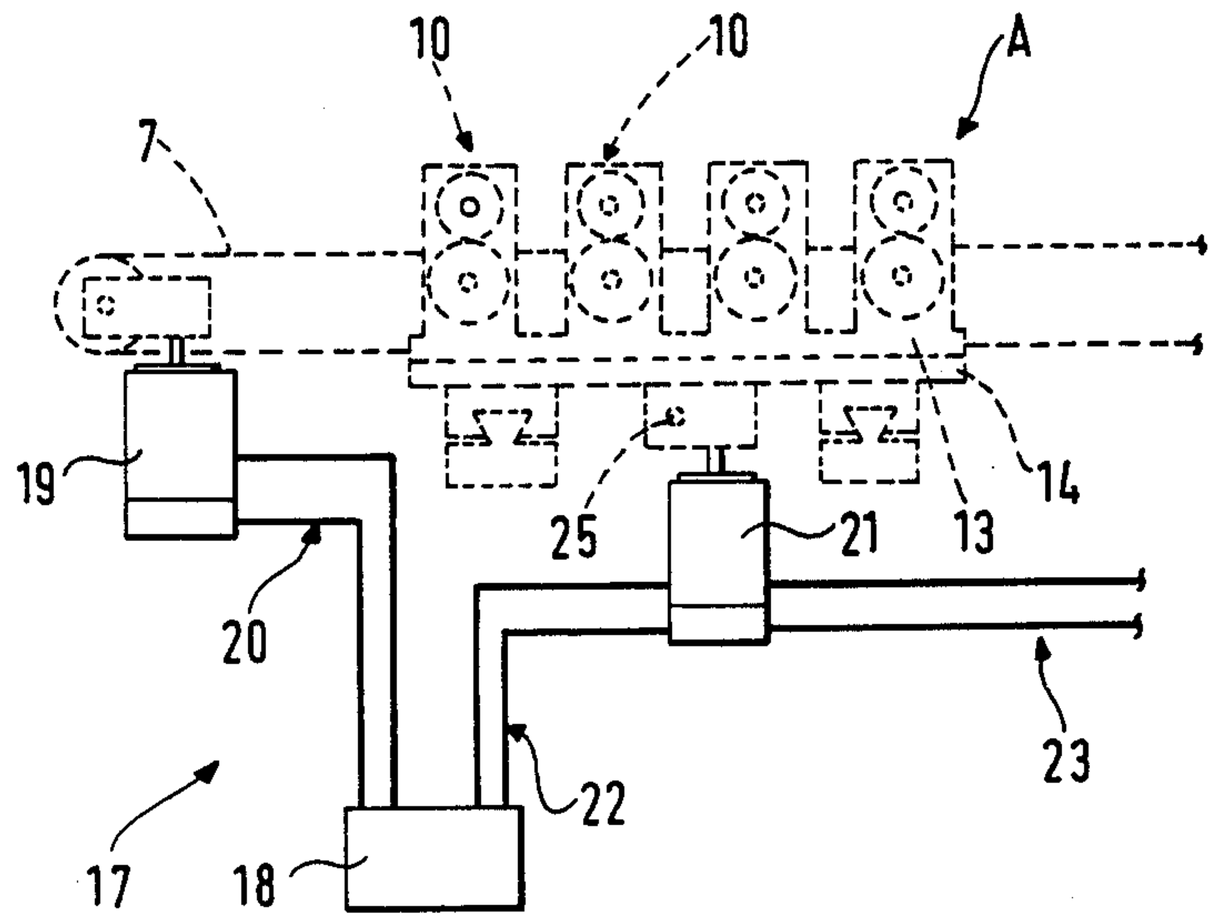


Fig. 5

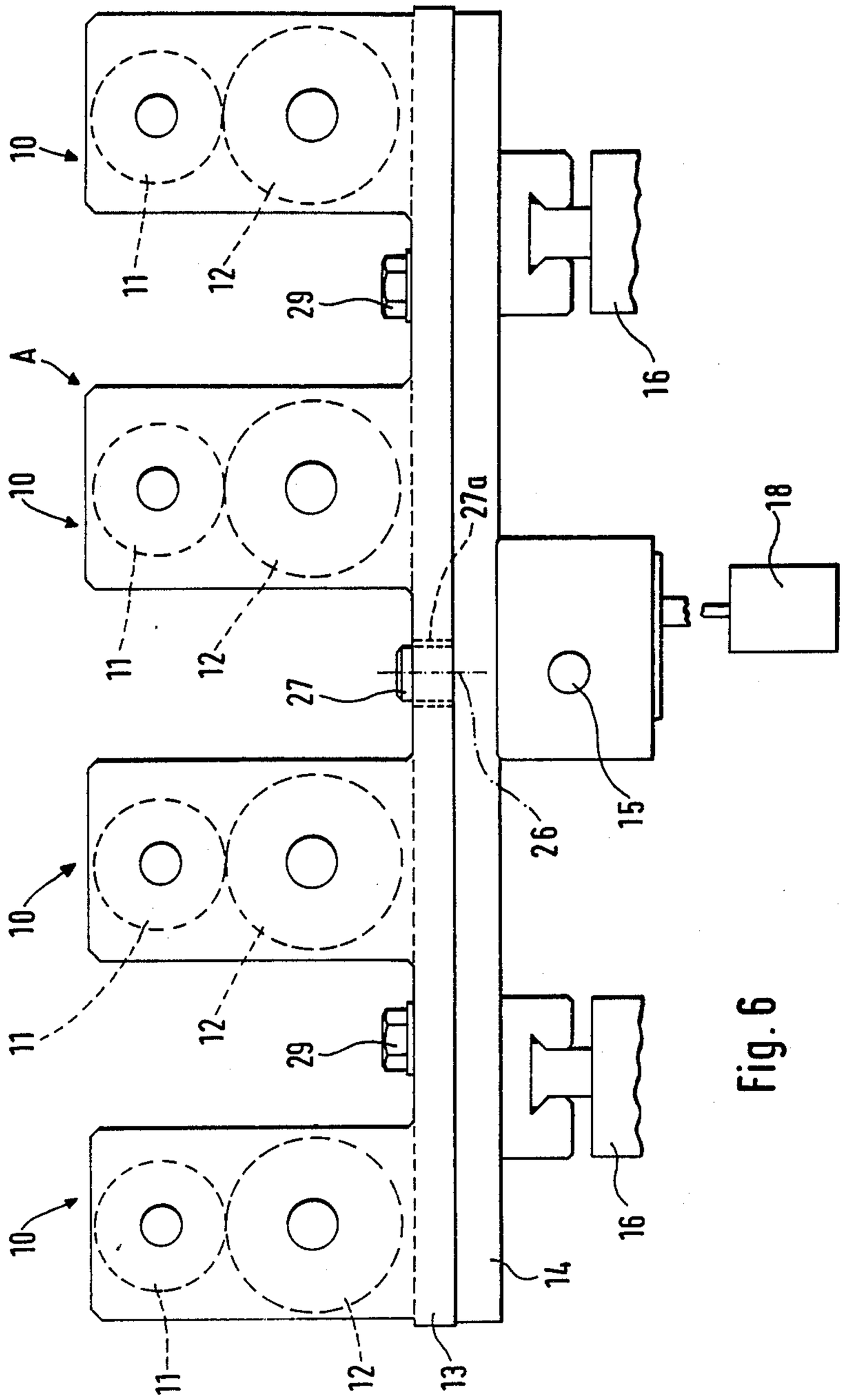


Fig. 6

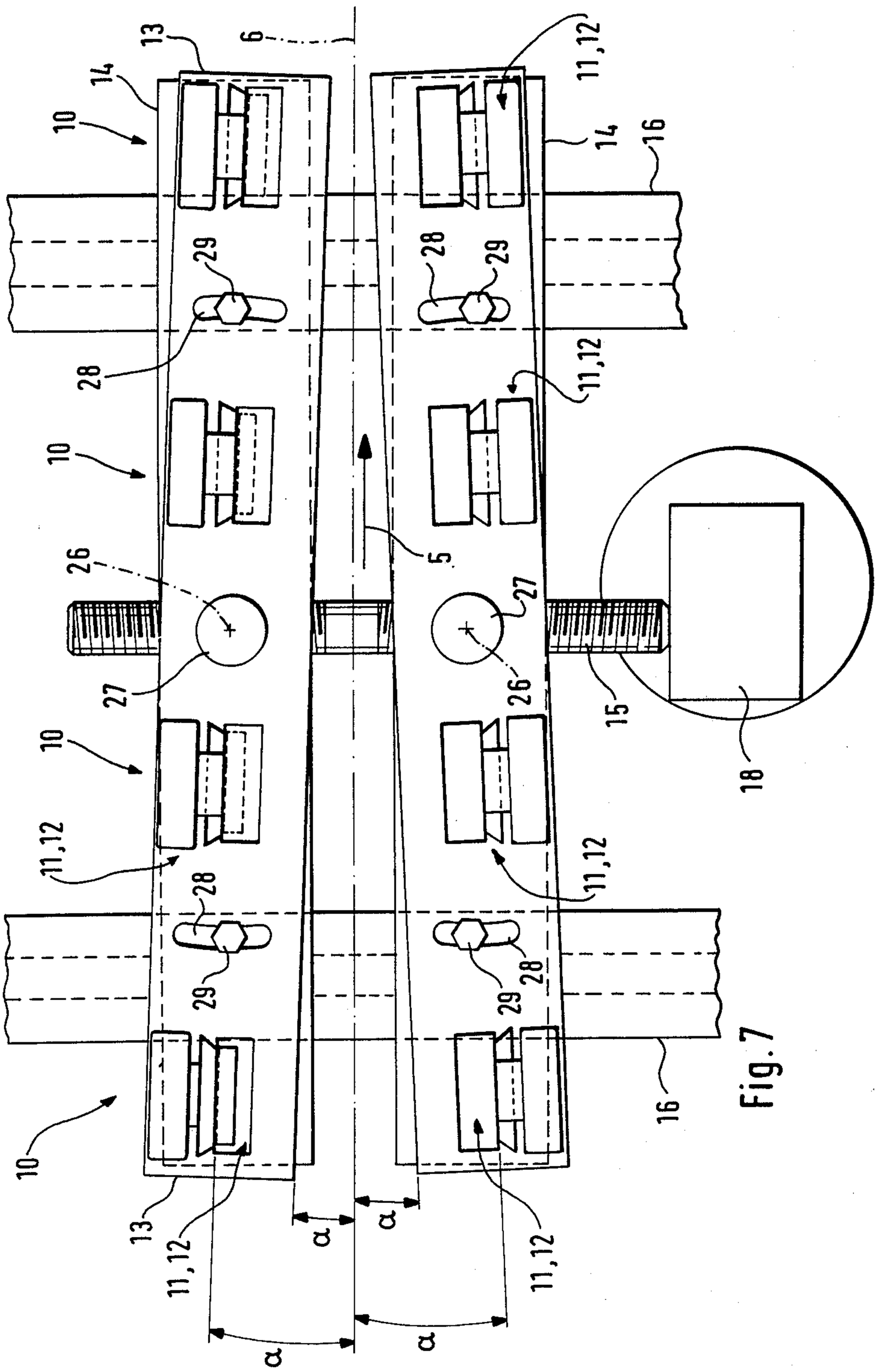

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Fig.7

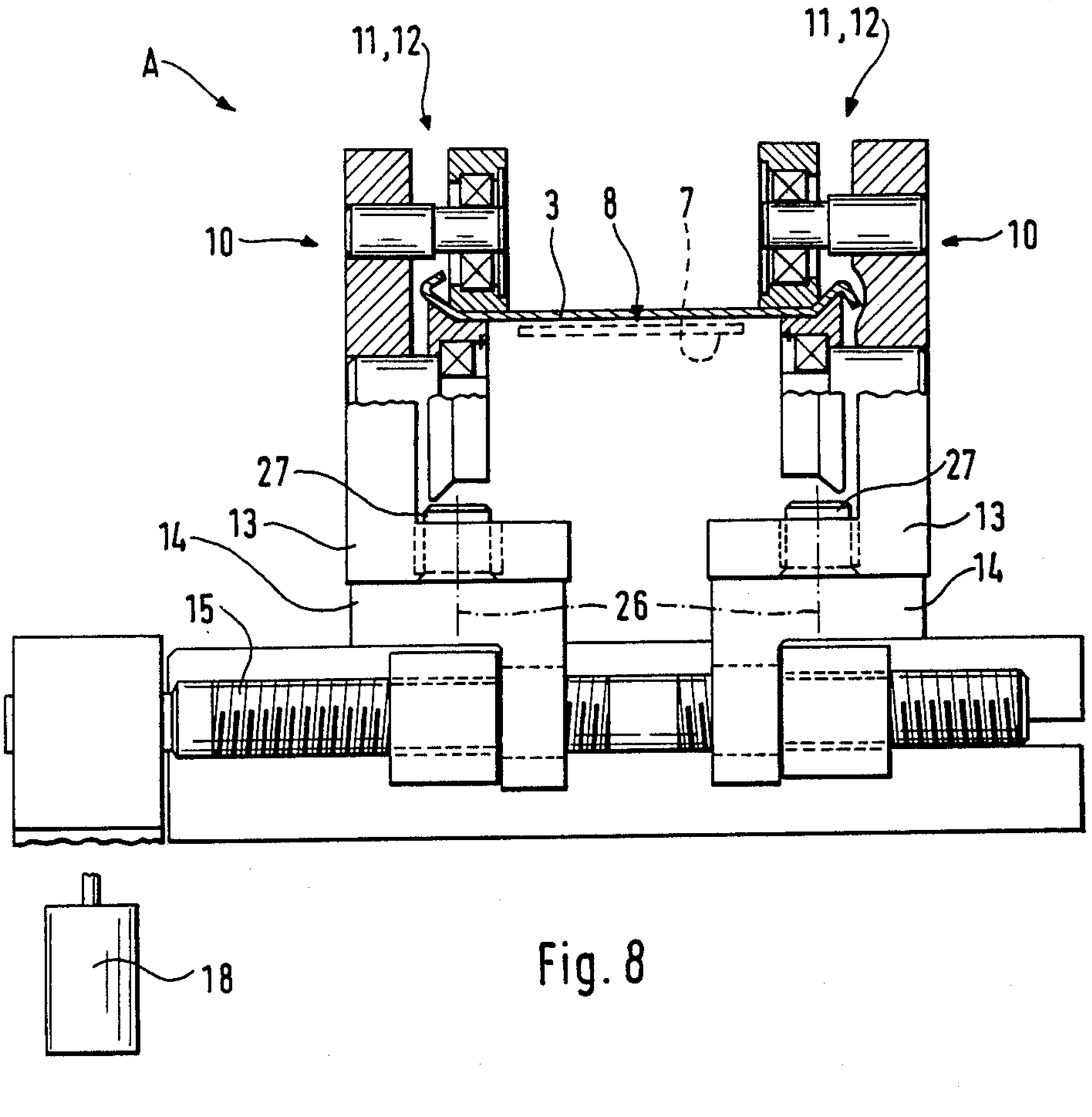

Fig. 8

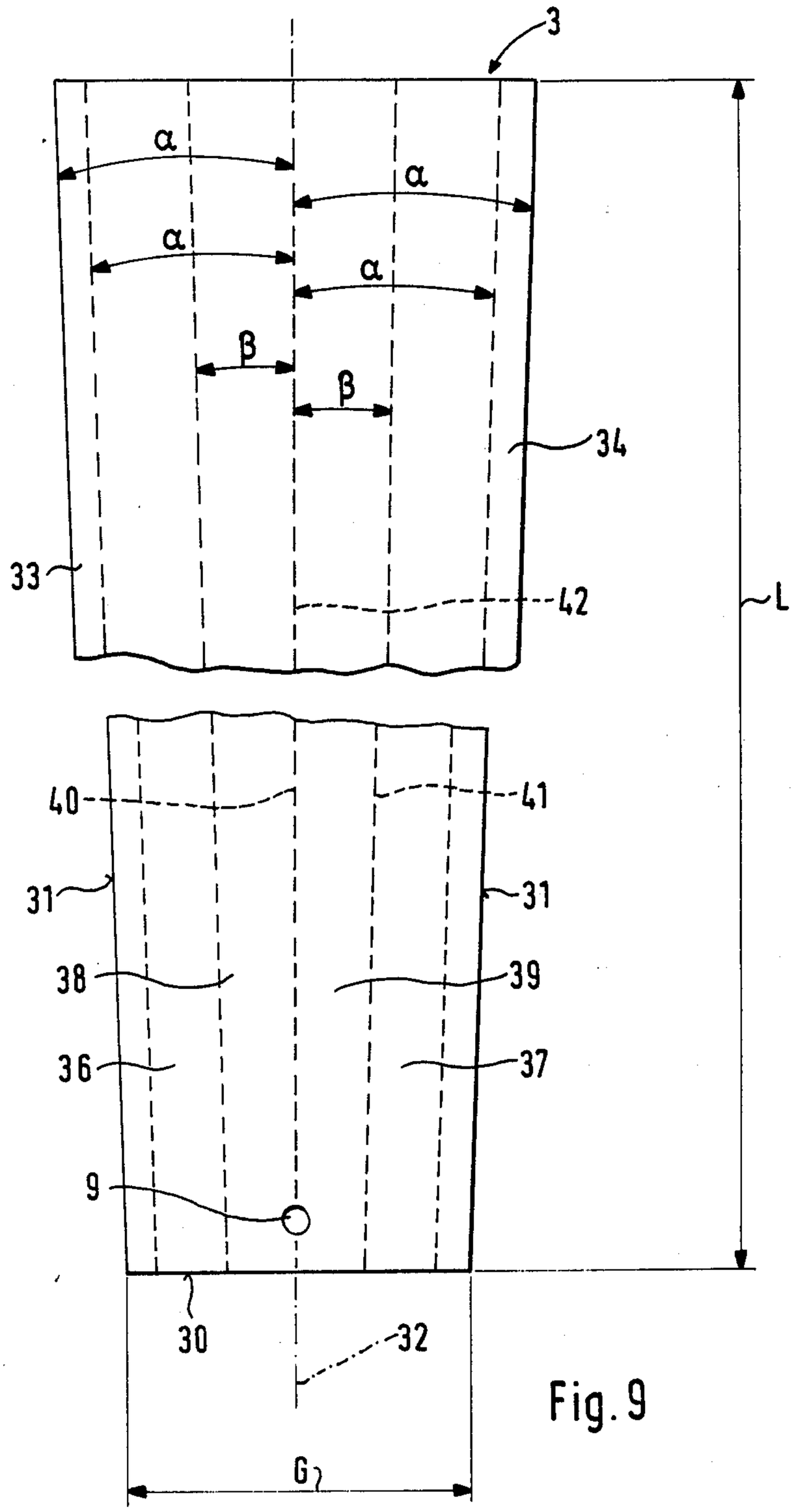

Fig. 9

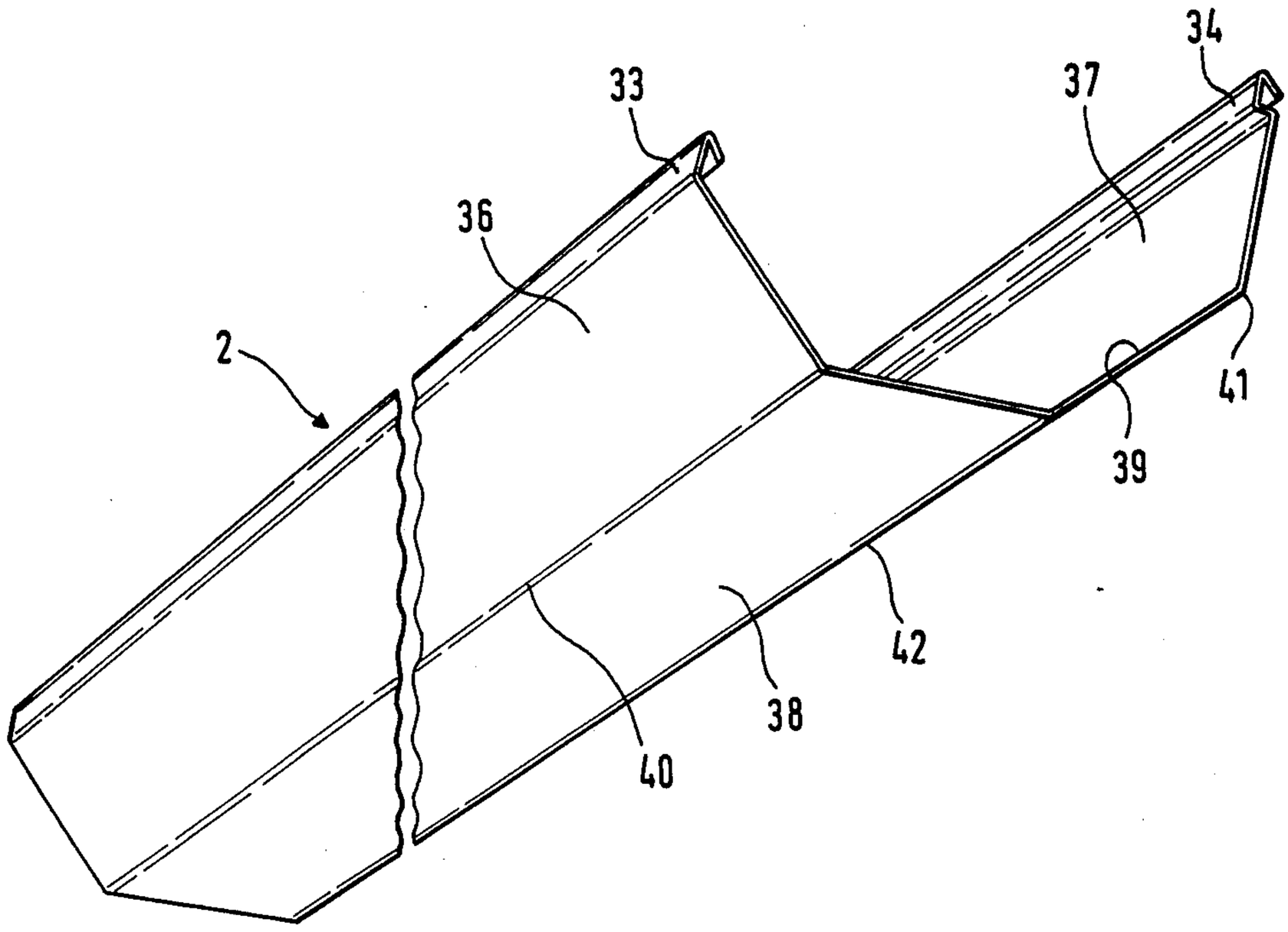

Fig.10

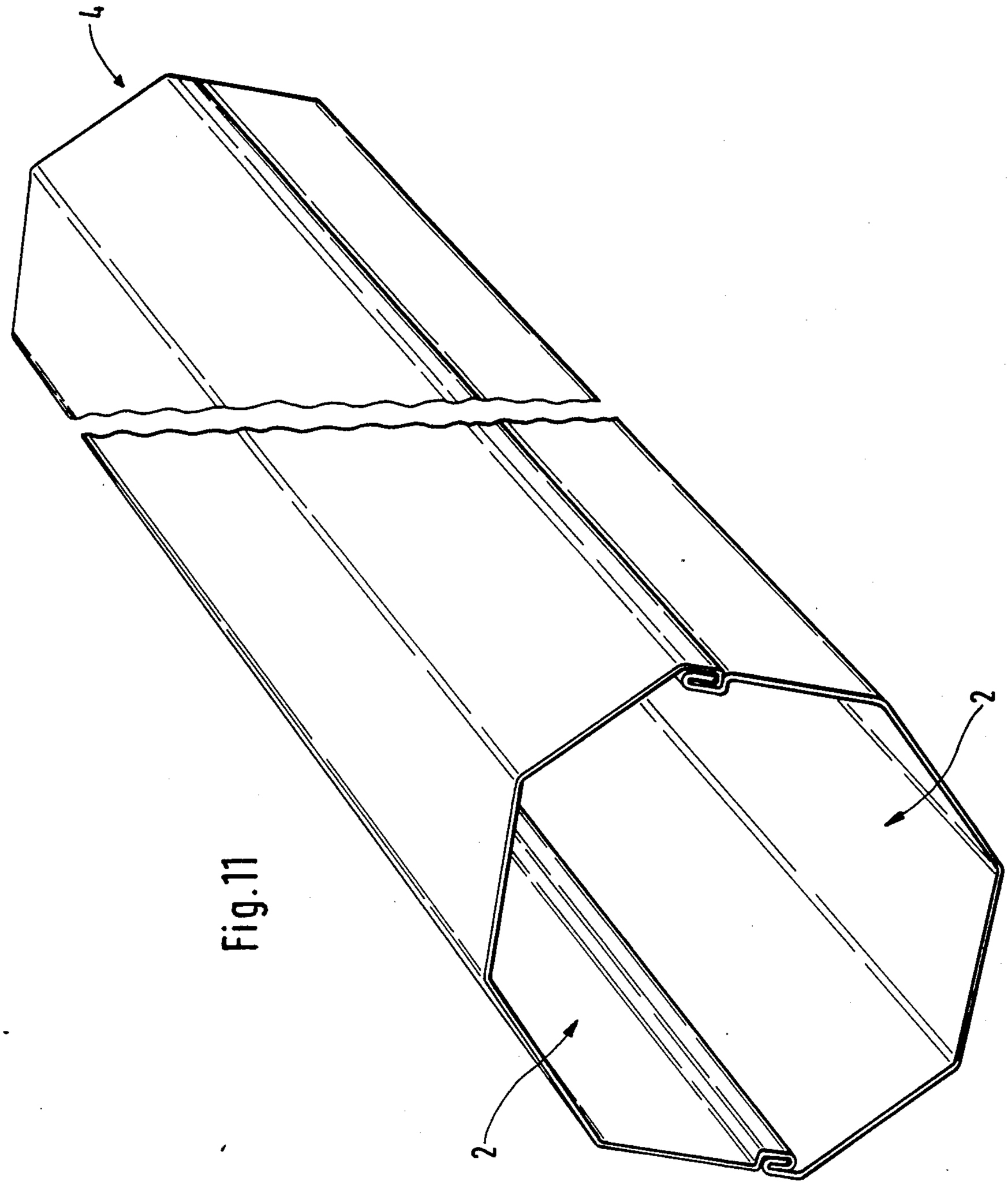

Fig.11

DEVICE FOR MANUFACTURING CONICAL POLES

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a device for manufacturing conical poles or conical pole members by roll forming sheet metal, said device comprising a conveyor path along which sheet metal is transported, and a plurality of groups of forming rolls positioned in succession along the conveyor path, whereby one or more forming rolls in a group are provided on one side of a longitudinal center line of the conveyor path and one or more forming rolls in the group are provided on the other side of said center line.

2. Description of the Related Art

From the GB patent specification 1 538 955 it is already known to utilize roll forming for manufacturing poles. The publication, however, does not define any device for manufacturing conical poles or pole members of great lengths, i.e. 15 m or more.

The U.S. patent specification No. 3,903,723 defines a roll forming device for manufacturing sheet metal details with conical portions. This prior art roll forming device however, is not intended for roll forming long, conical poles, where great precision is required and where a small setting error is enlarged many times because of the great length of the poles. The prior art roll forming device further does not permit e.g. outer portions of the poles to be provided with longitudinal edges with a certain conical form, while e.g. inner longitudinal edges extend with another conical form. Furthermore, after having manufactured poles with a certain conical form, the prior art device does not permit quick and simple resetting thereof for manufacturing poles with another conical form.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a device for manufacturing conical poles or pole members of great lengths.

While the device according to the invention permits inclination of the forming rolls as defined and while the degree of inclination may vary, it is ensured that the forming is exact and without shearing stresses in the material to be formed. Additionally, different portions of the poles can be given different conical forms and after the manufacture of poles or pole members with a certain conical form, the device is simply and quickly reset for manufacturing poles or pole members with another conical form.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be further described below with reference to the accompanying drawings, in which

FIG. **1** is a side view of a schematically illustrated device according to the invention;

FIGS. **2–4** are cross sectional views of the sheet metal material as said material is formed in the device of FIG. **1**;

FIG. **5** schematically shows a control system for controlling the device of FIG. **1**;

FIG. **6** is a side view of a roll forming station forming part of the device of FIG. **1**;

FIG. **7** is a top plan view of the roll forming station of FIG. **6**;

FIG. **8** is a cross section of the roll forming station of FIG. **6**;

FIG. **9** is a plan view of sheet metal prepared for manufacturing a pole member;

FIG. **10** is a perspective view of a pole member formed of the sheet metal material of FIG. **9**; and

FIG. **11** is a perspective view of a pole consisting of two pole members according to FIG. **10**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The device **1** illustrated in the drawings is adapted for manufacturing conical pole members **2** by roll forming sheet metal **3**. Said pole members are interconnected to form conical poles **4** (FIG. **11**).

For roll forming the pole members **2**, the device **1** comprises a conveyor path **5**, the longitudinal center line of which is designated **6** (FIG. **7**). The transport of the sheet metal **2** along the conveyor path **5** is made by a conveyor chain **7** with grip means **8** which are inserted into holes **9** in the sheet metal **3** (FIG. **9**).

A number of roll forming stations A, B and C are provided along the conveyor path **5**. The illustrated device has three such stations. The roll forming station A has in this embodiment four successive groups **10** of forming rolls. At least one and preferably two forming rolls **11, 12** in each group **10** are provided on one side of the longitudinal center line **6**, while at least another and preferably two other forming rolls **11, 12** in the same group are provided on the other side of the longitudinal center line **6**.

The forming rolls **11, 12** on one side of the longitudinal center line **6** are movable towards said center line **6** at the same time as the forming rolls **11, 12** on the other side of the longitudinal center line **6** also are movable towards said center line **6**. Furthermore, the forming rolls **11, 12** on one side of the center line **6** are movable from said center line at the same time as the forming rolls **11, 12** on the other side of the center line **6** also are movable from said center line **6**. This pattern of movement is obtained while the forming rolls **11, 12** on each side of the center line **6** are provided on a frame member **13**, which in turn is mounted on a lower part **14** of the frame, and these lower parts **14** cooperate with a rotatably mounted double screw **15**. This screw includes a right-threaded portion which cooperates with one of said lower parts **14** of the frame, and a left-threaded portion which cooperates with the other lower part **14** of the frame. In order to control the lower parts **14** of the frame during their movements from and towards the center line **6**, said lower parts cooperate with one or more guide rails **16**.

The following roll forming station B is constructed in the same way as the roll forming station A, but has in this embodiment only three groups **10** of forming rolls **11, 12** instead of four.

The third roll forming station C is provided for forming a central corner in the sheet metal **3** and it therefore includes two groups **10** of forming rolls **11, 12** which are not movable from/to the center line and mounted such that they can form said corner along this center line **6**.

A control system **17** for controlling the moveable members of the device is known schematically in FIG. **5**. This control system **17** includes a control unit **18** which is connected to the drive aggregate **19** of the conveyor chain **7** through conduits **20**, to the drive aggregate **21** of the double screw **15** through conduits **22** and through conduits **23** to a drive aggregate **24** for

a double screw **25** on the roll forming station B. The control system **17** is provided to operate the various drive aggregates **19, 21, 24** at such speeds that the sheet metal **3** takes the appropriate conical form.

In order to e.g. facilitate roll forming and substantially eliminate the risk of subjecting the sheet metal to flexural/tensile stresses or shearing stresses at the various stations, each frame member **13** is pivotable about a vertical axis **26**. It is therefore possible to set the frame members **13** and thus, the forming rolls **11, 12** at such angles α relative to the center line **6** of the conveyor path **5** so that the desired conical form may be achieved for the finished pole member **2** or portions thereof.

Turning to FIG. **6**, the vertical axis **26** may be defined by a pivot **27** which is mounted on the lower part **14** of the frame and protrudes into a recess **27***a* in the frame member **13**. The axis **26** about which the frame member **13** is pivotable may, however, be designed in another way—the frame member **13** may e.g. have a depending pivot which protrudes into a recess in the lower part **14** of the frame.

As shown in FIG. **7**, each frame member **13** has two arcuate long-holes **28**, the arcs of which are centered with the axis **26**. Locking means in the form of manually tightenable bolts **29** which are threaded in the lower part **14** of the frame are mounted in said long-holes **28**. When the frame members **13** and thus, the forming rolls **11, 12** are set in their predetermined angular positions α relative to the center line **6**, the bolts **29** are tightened, whereby the positions of the frame members **13** are fixed relative to the lower parts **14** of the frame. If the frame members **13** have an elongate shape as is shown in FIG. **7**, the axes **26** are preferably provided centrally in the frame members **13** and one or more long-holes **28** are provided at substantial distances from said axes **26**.

At the roll forming station B there is a corresponding axis **26** about which the frame members **13** are pivotable, as well as corresponding long-holes **28** and bolts **29** as in the roll forming station A, i.e. the frame members **13** in the roll forming station B are also settable in various angular positions relative to the center line **6** of the conveyor path **5**.

In FIG. **9** a sheet metal blank **3** is illustrated, which blank is to be roll formed in the device **1** to a four-sided pole member **2** of the type shown in FIG. **10**. By way of example, the length L of the sheet metal **3** (=length of the pole **4**) is 15 m and its width G at the shortest end side **30** is 0.2 m. The sheet metal **3** is cut in such a way that each of its longitudinal sides **31** extend at an angle α of 0.5° relative to the longitudinal center line **32** of the sheet metal **3**. Connecting portions **33, 34** are to be formed along the sheet metal **3** at station A, said portions being adapted to permit interconnection of two pole members **2** to form a pole **4**. The connecting portions **33, 34** are to be roll formed along lines **35** running parallel with the long sides **31**, i.e. at an angle α of 0.5° relative to the center line **32**.

Four sides **36, 37, 38, 39** are also to be formed along the sheet metal **3**, the corners of which run along lines **40, 41** and **42**. The corners along the lines **40** and **41** shall run at an angle β of 0.25° relative to the center line **32** and the corner along the line **42** shall run in the center line **32**.

Before this sheet metal **3** is fed into the device **1**, the control system **17** is programmed such that the connecting portions **33, 34** are formed at the station A with an angle α of 0.5°. The sides **36, 37** with the corners running along the lines **40, 41** are formed at the station B with an angle β of 0.25° and the corner along the line **42** is formed at the station C. Before forming starts, the frame members **13** at the station A are pivoted about their axes **26** until the forming rolls **11, 12** mounted thereon extend at an angle α of 0.5° relative to the center line **6** of the conveyor path **5**, whereafter the frame members **13** are fixed by means of the bolts **29**. The frame members **13** at the station B are pivoted until the forming rolls **11, 12** mounted thereon extend at an angle β of 0.25° relative to the center line **6** of the conveyor path **5**. The sheet metal **3** is thereafter fed along the conveyor path **5** in the device **1** by means of the conveyor chain **7** and with its center line **32** centered with the center line **6** of the conveyor path **5**. When the sheet metal **3** has passed the station C and leaves the device **1**, it is completely formed into a pole member **2** according to FIG. **10**. Two such pole members **2** are thereafter interconnected to form a pole **4** in a suitable manner.

If one wishes to manufacture pole members **2** with another conical form, i.e. with angles α than 0.5° and angles β than 0.25° in the device **1**, the control system **17** is easily reprogrammed and the angular positions α and β of the frame members **13** quickly altered by loosening the bolts **29**, pivoting the frame members **13** about the axes **26** and again tightening the bolts **29**. Since the great lengths of the poles normally required the angles α and β to be set exactly. a setting device (not shown) with a micrometer scale is preferably used. The setting of the angles α and β of the frame members **13** may also be carried out mechanically instead of manually.

The pole **4** shown in the drawings and described above has eight sides and its members **2** are preferably made by means of a device **1** having three stations as shown in FIG. **1**. An important advantage with the device is that it is easily resettable for manufacturing poles with another number of sides, e.g. six-sided poles (whereby e.g. only two stations are required), ten-sides poles (whereby e.g. three stations are sufficient) and twelve-sided poles (whereby e.g. four stations are needed).

The invention is not limited to the device illustrated in the drawings and described above, but may vary within the scope of the following claims. As an example of alternatives not described above, it can be mentioned that it is possible with the above device to form poles consisting of only one pole member instead of two or of another suitable number of pole members which are interconnected. Each station in the device may include one or more groups of forming rolls; there may be one or more locking means for fixing the frame members **13** in their angular positions; said locking means need not be bolts; and instead of a conveyor chain, another suitable transport device may be utilized for transporting the sheet metal.

I claim:

1. A device for manufacturing a conical pole member by roll-forming sheet metal, comprising:

a conveyor path along which said sheet metal is transported; and

a plurality of roll-forming groups provided on either side of a longitudinal center line defined by said conveyor path, each said roll-forming group one one side being displaceable towards and from each other roll-forming group during roll formation and including at least one forming roll pivotably mounted on a frame member, wherein at least first and second of said roll-forming groups on one said side are pivotably mounted about an axis substan-

tially perpendicular to said longitudinal center line and at respective desired angular positions so that said first group roll-forms sheet metal conveyed thereto at the first angle relative to said center line, and said second group roll-forms sheet metal conveyed thereto at a second angle relative to said center line, said first angle being variable relative to said second angle.

2. A device for manufacturing conical pole members as claimed in claim **1**, wherein all forming rolls set at a common angle on the same side of the center line are pivotably mounted to a common frame member.

3. A device for manufacturing a conical pole member as claimed in claim **1**, further comprising manually operable locking means for locking said frame members in said angular positions.

* * * * *